LEMBAR
HASIL PENILAIAN SEJAWAT SEBIDANG ATAU *PEER REVIEW*
KARYA ILMIAH : PROSIDING

Judul Karya Ilmiah (paper) : Influence of pore water pressure to seepage and stability of embankment dam (case study of Sermo Dam Yogyakarta, Indonesia)
Jumlah Penulis : 4 orang (Udayani Cita Sari, Sri Prabandiyani Retno Wardani, Suharyanto, Windu Partono)
Status Pengusul : ~~penulis pertama~~/ penulis ke 4 / ~~penulis korespodensi~~

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Total = (100%)	**25.20**	**29.00**	**27.10**

Penulis ke 4 dari 4 = (27.10 x 40%)/3 = 3.61

Reviewer I

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Reviewer II

Prof. Dr. Ir. Sri Tudjono, MS
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Unit kerja : Departemen T.Sipil FT.UNDIP

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c) Riset memberikan konstribusi terhadap perilaku sebuah dam, namun kesimpulan yang disajikan sangat umum, dan belum spesifik mengarah ke manfaat dan fungsi studi. Pustaka cukup, namum pustaka terbitan 10 tahun terakhir terbatas
d) Matec pada tahun 2017 terindex Scopus, dan sebagai penerbit berpengalaman panjang, penyelenggara Universitas Sriwijaya merupakan salah satu universitas terkemuka, dan organizing committee memiliki reputasi ilmiha bagus

Penulis II dari 3 : $\frac{0.4}{3} x 25.2 = 3.36$

Semarang, 11-2-2019
Reviewer

Prof. Dr. Ir. Han Ay Lie, M.Eng.
NIP.19561 091985032002
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LEMBAR
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b. Ruang lingkup dan kedalaman pembahasan (30%)	9.00		8.50
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Total = (100%)	**30.00**		**29.00**

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d. Kelengkapan unsur dan kualitas penerbit

Penulis II dari 3 : 0,4/3 x 29 = 3,87

Semarang,
Reviewer

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Influence of pore water pressure to seepage and stability of embankment dam (case study of Sermo Dam Yogyakarta, Indonesia) (Conference Paper) (Open Access)

Cita Sari, U., Prabandiyani Retno Wardani, S., Suharyanto, Partono, W.

Civil Engineering Department, Faculty of Engineering, Diponegoro University, Semarang, 50275, Indonesia

Abstract

View references (15)

Today, water requirements are not analogously with its availability. Therefore, build water reservoir dam is one of the simple concepts for fulfilling water requirements. Embankment dam is one of the most popular dam build in Indonesia. Stability of embankment dam should be taken into account to evaluate the safety condition in retaining water. Safety against seepage is one of the most important steps for checking the possibility of failure of embankment dam. PLAXIS is alternative software that can be used for evaluating safety of embankment dam due to seepage condition. This paper explains the study of pore water pressure and seepage effects against Sermo Dam safety using PLAXIS and compares it with field measurement data from piezometer and V-Notch monitoring. The study was conducted during dam operational conditions. The analysis was carried out using Mohr-Coulomb model to calculate discharge of seepage and settlement. The value of pore water pressures within the model, upstream and downstream, positions are then reviewed with the real dam. The results of model analysis shows that the more higher water level within the dam reservoir the more higher pore water pressure will be happened that affects in increasing discharge of seepage and settlement of dam.

SciVal Topic Prominence

Topic: synthetic aperture radar | Subsidence | persistent scatterers

Prominence percentile: 98.639

Indexed keywords

Engineering controlled terms: Dams | Embankment dams | Embankments | Pore pressure | Pressure distribution | Rivers | Safety engineering | Seepage | Water | Water levels

Engineering uncontrolled terms: Field measurement data | Mohr Coulomb model | Operational conditions | Pore-water pressures | Safety condition | Seepage and stabilities | Stability of embankments | Water requirements

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PROCEEDINGS

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Bangka Island Indonesia, 8-10 November 2016

A Conference by
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TABLE OF CONTENTS

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SICEST PROCEEDINGS
SRIWIJAYA INTERNATIONAL CONFERENCE ON ENGINEERING, SCIENCE & TECHNOLOGY

Quantification of Emissions Rates of NOx based on Equipment and Engine Tier Types for Diesel Construction Equipment

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Abstract: The use of construction equipment in all construction projects is a must not only to accelerate the project time but also to increase the productivity at job sites. One of most important challenges in construction projects is to decrease fuel use and emissions from diesel equipment. This paper aimed to quantify the emission rates of NOx from diesel construction equipment based on equipment and engine tier types. Weighted average approach was used to quantify the emission rates of NOx for 32 items of construction equipment. The average percentage of time in each engine mode for all types of equipment decreased as engine load increased, given by more than 70% of time for off-road truck in engine mode 1. Meanwhile, the average emission rates increased as engine load increased. The results showed that the engine tier 0 had the highest amount of NOx compared to engine tier 1 and 2, accounting for about 3.68 g/hp-hr for tier 0, 2.01 g/hp-hr for tier 1 and 1.39 g/hp-hr for tier 2. However, among other equipment, the off-road truck produced the lowest amount of NOx for all engine tier types.

Keywords: construction equipment, emission rates, NOx, equipment type, engine tier

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1. INTRODUCTION

The use of construction equipment in all construction projects is a must not only to accelerate the project time but also to increase the productivity at job sites. One of most important challenges in construction projects is to decrease fuel use and emissions from diesel equipment. In fact, most of construction equipment is powered by diesel engines which consume a significant amount of fuel and release a huge amount of pollutants into the environment. These emissions cause health problems to humans such as premature death, asthma attacks, lung cancer and lung damage and respiratory symptoms (EPA, 2002).

Studies on quantification and characterization of emission pollutants from diesel equipment have been increasing. Some addressed the use of engine dynamometer tests (Tehranian, 2003; Atkinson et al., 2000; Thompson et al., 2000; Clark et al., 2002; Hashemi, 2007); meanwhile, others focused on real-world emissions measurements (Abolhasani et al., 2008; Lewis, 2009; Rasdorf et al., 2010; Frey et al., 2008; Kim, 2007, Lewis et al., 2015). Lewis et al. (2012) studied the influence of engine idling with respect to fuel use and emission rates of CO2 for HDD construction equipment. This study determined the operational efficiency of each item of equipment indicated by the ratio of nonidle time to total equipment use time. The results showed that nonidle fuel use and emission rates were significantly higher than those in idle condition. In addition, results also showed that as idle time increased, the fuel use and emissions rates of CO_2 increased significantly.

Lewis (2009) presented a methodology for measuring the weighted-average fuel use and emission rates of HDD construction equipment while performing common duty cycles. Multiple linear regression models were developed for engine mode 2-10 based upon horsepower and engine tier. However, results showed that R^2 values were low and ineffective. Thus, average modal emission rates of each pollutant were developed to obtain more reliable models. With respect to the results indicating comparison of the actual and estimated fuel use and emission rates, the response plots demonstrated that the methodology was reliable enough in estimating fuel use and emission rates. However, this study was only limited to estimating engine modes for each different type of equipment without characterizing fuel use and emissions using equipment type and engine tier type divisions. This paper highlights on a comprehensive quantification of emission rates using weighted average approach based on equipment type and engine tier type.

2. METHODOLOGY

In this study, data were classified into seven types of diesel construction equipment consisting of six backhoes, six bulldozers, three excavators, six motor graders, three off-road trucks, three track loaders, and five wheel loaders. For each item of equipment, the datasets were comprised of a second-by-second basis of emission rates of NO_x. Based upon the engine attributes, the equipment was further categorized into engine tier types containing of engine tier 0, tier 1, tier 2, and tier 3. The engine tier types were determined based on the model year and the engine size of the specified diesel equipment.

Engine load was then defined by measuring the MAP, which was used as a surrogate for engine load. Since most of the equipment had various ranges of MAP values, normalization of the MAP was conducted. In the engine modal analysis, the fuel use and emission rates were quantified for 10 different individual engine modes. Once the engine modal analysis for each engine mode was conducted, the average of emission rates for each engine mode could be quantified. In other words, the fraction of emission rates in each engine mode for each item of equipment could be estimated. The overall modal weighted average emission rates of NO_x was calculated by multiplying the

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SICEST PROCEEDINGS
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Advanced Nanomaterials for Water and Wastewater Treatment: From Strategic Fundamental Research to Industry Adoption

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Abstract: Water and wastewater treatment is known to be one of the most sustainable solutions to provide fresh and safe water for many water stressed communities and industrial sectors. Over the last decade, some concrete evidences indicate that the advances in advanced materials, particularly nanomaterials, have facilitated the next paradigm shift in the water and wastewater treatment processes. As the integration of nanotechnology with these processes is most likely to dominate the future research attention and the water treatment market, this presentation timely discusses the state-of-the-art overview on the enabling and cutting edge water and wastewater technology integrated with advanced nanomaterials in term of the technological needs and future perspective, which include the challenges and opportunities of nano-enabled water treatment processes. The key issues such as scale-up, economic competitiveness, potential environmental impacts and energy consumption are discussed. This presentation also aims to provide directions and guideline to the research community regarding the future outlook and roadmap of the application of nanotechnology to heighten the performance of the existing water and wastewater treatment processes in bench-scale and commercialization level. By taking all key aspects into account, the water community should reach a general consensus on a holistic technological strategy to make decision about the future direction of nano-enabled water and wastewater treatment scenario. It is crucial to identify the missing pieces and create effective linkages among important elements in order to embrace the revenue-based opportunities of this technology at its best time.

Keywords: advanced nanomaterials, water and wastewater treatment

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SICEST PROCEEDINGS

SRIWIJAYA INTERNATIONAL CONFERENCE ON ENGINEERING, SCIENCE & TECHNOLOGY

Microwave-Assisted Extraction of Phenolics from Pineapple (Ananas comosus) Peels for Green Zero-Valent Iron Production

Capili, Marc Joseph, Lombos, Owen, Oblepias, Carmelle, Uy, Marylou and Cynthia F. Madrazo*

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Abstract: This study focused on the optimization of the microwave-assisted extraction (MAE) of phenolic compounds from pineapple (Ananas comosus) peel. Pineapple peels were used because of the high pineapple production in the country, which also means that large amount of pineapple wastes are available. It is also known that pineapples are rich in phenolic compounds and one of the efficient ways of extracting phenolic compounds in plant matrices is by MAE. In this study, MAE was done to optimize the extraction considering various parameters such as extraction time (1 to 5 min), solvent-to-solid ratio, SSR (10:1 to 50:1), and microwave power (100W, 300W, 500W), using 95% (v/v) ethanol as solvent. The phenolic yield was determined using Folin-Ciocalteu method in terms of gallic acid equivalents (GAE). The yield ranges from 0.6479 to 3.7466 mg GAE/g dry peel. The optimum yield (or yield with highest value) was obtained at parameters 300W, 50 SSR and 5 min. It is important to extract these phenolics because of its many beneficial properties and uses. One of its possible applications is as a reducing agent for Zero-Valent Iron (ZVI) production. ZVI, also known as elemental Iron, is a substance which could be used in treating wastewater. After optimization for maximum yield using response surface methodology, the optimum sample extract was obtained and was reacted with an iron (III) chloride solution to form the ZVI particles. Scanning electron microscopy was done to optically confirm ZVI particles, while an energy-dispersive x-ray spectroscopy was utilized to elementally determine the presence of Iron. It can be concluded that microwave-assisted extraction is effective for extracting phenolics from pineapple peels.

Keywords: phenolics; zero-valent iron; microwave-assisted extraction

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1. INTRODUCTION

Clean water is one of the most valuable resources today. Due to the wastes from industrial processes, a substantial portion of clean water is contaminated with foreign substances, such as dyes, thus requires treatment before they can be utilized again. One treatment method known is the use of Zero-Valent Iron or ZVI, an iron compound that carries no electrical charge and has great potential to be an agent for contaminant removal in wastewater.

ZVI is conventionally synthesized by using sodium borohydride (NaBH4) as the reducing agent [1]. However, this agent is expensive and hazardous to the environment. The environmental problems involved with the toxicity of sodium borohydride (NaBH4) can be seen to have defeated the purpose of ZVI. In order to address this, many researchers focused on plant extracts as alternatives to NaBH4 [2,3,4].

One possible plant extract as a reducing agent for ZVI production is the phenolic compounds from pineapple (*Ananas comosus*) peels. Pineapple peels are known to contain high amount of phenolics. Over 14 million tons of pineapples are produced yearly, making it the eight most abundantly produced fruits in the world [5]. According to an article from the website of the country's Department of Agriculture, Philippines is the top exporter of juice concentrates such as pineapple juice. Thus, a large amount of pineapple peel, which constitutes around 41% of the total mass of pineapple [6], is being generated in the Philippines.

This study aimed at the optimization of the microwave-assisted extraction (MAE) of phenolic compounds, from pineapple peel, and at the production of ZVI using phenolic compounds obtained from extraction parameters with the optimum result.

2. METHODOLOGY

A. Preparation of Pineapple Peel

Fresh pineapple peels are obtained from pineapples of Formosa variety and are available in a local market. The said variety is chosen because it is abundant in the Philippines [6]. The peels are removed from the pineapple using a kitchen knife. The peels are then freeze-dried, ground and stored in the refrigerator before extraction.

B. Design of Experiments and Statistical Analysis

Optimization of the MAE was based on three factors: extraction time, microwave power, and solvent-to-sample ratio (SSR). In this study, extraction time and SSR were treated as continuous variables because these two can be set with small increments, while microwave power was termed as a discrete variable because the microwave used did not allow small increments on its power setting. The relationships among each variable with respect to the extraction yield were approximated using a second order polynomial.

The statistical program, Minitab 17, was used to apply statistical analysis to the experimental data and obtain optimized parameters for extraction. The 'Design of Experiment – Response Surface Methodology' module was used for this experiment.

A two-level full factorial scheme was used for analysis having the following characteristics: cube points – 12; center points in cube -15; axial points – 12; center points in axial – 0; and α – 1. In addition, a confidence value of 95% (p-value = 0.05) was used in this analysis. The program used ANOVA to determine significance of primary variable effects and variable interaction effects, as well as the model characteristics.

C. Microwave-Assisted Extraction (MAE) of Phenolics

Extraction of phenolic compounds was done using a microwave set-up equipped with a condenser and a thermocouple as shown in Figure 1. The solvent used was an ethanol-water mixture of 95-5% (v/v).

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SICEST PROCEEDINGS
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Bentonite-biochar Composite for Heavy Metals Removal

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Abstract: A clay composite material was prepared bentonite and water hyacinth. The bentonite used in this study was obtained from Pacitan, East Java, Indonesia. The preparation of bentonite-biochar composites were conducted at temperatures between 400 to 500oC under carbon dioxide or steam environment. The characterizations of the composites were conducted using nitrogen sorption, X-Ray Diffraction, and scanning electron microscope methods. Combination of micropore and mesopore structures were observed in the composites. In order to examine the adsorption capability of the composites, a series of liquid phase adsorption experiments were conducted in a static mode at 30oC. Cu(II) and Pb(II) were used as the adsorbates in the adsorption experiments. The concentration of heavy metals in the solution was determined by atomic absorption spectrophotometer. Widely used adsorption isotherm models, Langmuir and Freundlich, were employed to correlate the experimental data, and the results indicate that the Langmuir model could represent the adsorption experimental data better than the Langmuir model. For the kinetic study, the pseudo-first and pseudo-second models were used to correlate the kinetic data. Pseudo-second gave better performance than pseudo-first in correlating the kinetic data.

Keywords: Bentonite-biochar, composite, adsorption, heavy metal

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CeO_2-Al_2O_3 Xerogel as an Oxygen Storage Support in Ni Catalysts With Enhanced Reducibility

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Abstract: The most characteristic of CeO2 is the oxygen storage capacity (OSC) to enhance the Ni catalyst performance by coke removal. In this study, the CeO2-Al2O3 supports were prepared by different method, a one-step sol-gel method and an impregnation cerium precursor on a commercial Al2O3. The behavior of oxygen storage/release and the oxygen storage capacity values on the mixed oxides were investigated at 500°C by using thermogravimetric analysis. Furthermore, in situ X-ray absorption near edge structure (XANES) was applied to study the reduction behaviors and the phase transformations of CeO2 in both the Ni catalysts. The oxygen was stored and released gradually and the high OSC of 247 µmol-O•g-1 was observed on the CeO2-Al2O3 support prepared by a one-step sol-gel method. The increase of OSC performance in the CeO2-Al2O3 was due to the homogeneity of the Ce species into the Al2O3 support. The Ni catalysts using a mixed oxide xerogel as the support showed the high reducibility of CeO2 and completely converted to Ce3+ species at temperature 600°C.

Keywords: CeO2-Al2O3 xerogel; Oxygen storage capacity; Time-resolved XAS; Reducibility
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1. INTRODUCTION

CeO2, a lanthanide oxide, is known as an oxygen storage material. It has been most frequently employed as the promoter on Al2O3 support in Ni-based catalysts for several reactions such as reforming of hydrocarbons, gasification of biomass and three-way catalysts (TWCs) [1-3] because of its properties. The results of the remarkable structural and chemical properties of CeO2 are the enhancement of the dispersion of the active metal, the improvement of the stability of the Al2O3 support, and the inhibition of metal sintering [4,5]. An important characteristic of CeO2, in which the research interests have been paid more attention, is the oxygen storage capacity (OSC). It is allowed to store and release oxygen to simultaneous supply the oxygen for oxidizing coke and CO, leading to a carbon removal and an enhancement of Ni catalysts stability [6].

As reported in the literature, a considerable number of current studies have prepared by the impregnation method because of its simplicity. However, the properties of the supports are uncontrollable. Sol-gel method has been frequently used to prepare the metal oxide supports with controllable properties and high homogeneity. It has been recently reported that the OSC values of the CeO2-Al2O3 mixed oxide prepared by a one-step sol-gel method increased with increasing of CeO2 loading. The highest OSC values was observed at high ceria loading (51 wt%) but it had a low surface area [7]. The effect of the preparation method of the CeO2-Al2O3 supports on their physical and structural properties has been recently investigated. It was found that the CeO2-Al2O3 mixed oxides prepared by a one-step sol-gel method exhibited the best activity for the selective reduction of NO with NH3 due to its high surface area, high NH3 adsorption capacity, strong interaction, high dispersion of ceria and good redox ability [8]. Although the effect of preparation method of CeO2-Al2O3 supports on physico-chemical and structural properties has been investigated, the effect of preparation method on the OSC performance and the reducibility of Ni-supported on that mixed oxide has not been reported. This work focused on the preparation method of the CeO2-Al2O3 support with high oxygen storage capacity to use as the promoted support in Ni catalysts via the one-step sol-gel method. Moreover, the enhancement of reducibility of the Ni catalysts were investigated by using *in situ* X-ray absorption near edge structure (XANES).

2. EXPERIMENTAL DETAILS

A. Preparation of CeO_2-Al_2O_3 and Ni/CeO_2-Al_2O_3

CeO_2-Al_2O_3 supports were prepared by different methods, a one-step sol-gel method and an impregnation method. The mixed oxide was prepared by the one-step sol-gel method done by using the mixture of $Ce(NO_3)_3{\cdot}6H_2O$ and Aluminium tri-sec-butoxide (ASB) as CeO_2 and Al_2O_3 precursors, respectively, which were dissolved in ethanol at 80°C. 0.1M HNO_3 was gradually dropped into the mixed solution. The gel was aged for 72 h. Finally, it was dried and calcined at 120°C and 800°C, respectively, for 3 h. The mixed oxide xerogel was denoted as CA(OS).

To compare the effect of the preparation method on the OSC property of the CeO_2-Al_2O_3 support, it was also prepared by the impregnation method. The ceria precursor was impregnated on a traditional Al_2O_3. The impregnated slurry was dried and calcined at the same temperature as described hereinbefore. The CeO_2-Al_2O_3 support prepared by the impregnation method was denoted as CA(IC).

The Ni/CeO_2-Al_2O_3 catalysts were sequentially prepared by the impregnation of the Ni precursor, $Ni(NO_3)_2{\cdot}6H_2O$, on both the mixed oxides as prepared. The drying and calcination conditions were followed by using the same conditions as explained above. The Ni catalysts were labeled as NCA(OS) and NCA(IC) for those supports prepared by the one-step sol-gel method and the impregnation method, respectively.

B. Characterization

The thermogravimetic analysis (TGA) was applied to measure the oxygen storage/release capacity of the mixed oxide supports. 10 mg of sample was held in an N_2 atmosphere during heating

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Kinetics and Mechanisms of Methane Oxidation on Supported Binary Platinum-Chromium Catalyst

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Abstract: Three types of supported catalysts were prepared and tested in methane oxidation. These catalysts were prepared by a conventional impregnation method. The kinetic parameters of methane oxidation over these catalysts are investigated at an atmospheric pressure and at a constant temperature 435 oC. The presence of a second metal (in this experiment was chromium) in the binary platinum-chromium catalyst improved the catalytic activity by activating more methane. Some reaction mechanisms of methane oxidation over binary platinum-chromium catalysts were proposed.

Keywords: Reaction mechanisms, Kinetics of methane oxidation, Methane oxidation, Chromium catalyst, Platinum catalyst, Binary platinum-chromium catalyst.

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1. INTRODUCTION

Methane gas is one of a contributor to global warming and it has high potent to green house effect. Methane gas produces by natural sources, such as wetlands and gas hydrates, or by human activities such as fossil fuel production and biomass burning. Methane oxidation has attracted much attention because it provides clean technology, it is an alternative route for energy production, and it provides a means of removing hydrocarbons from exhaust gas engines [1]. However, methane gas is the most resistant to oxidation reaction, as its relatively higher temperatures required to carry on the oxidation process than other volatile organic compounds. This is the reason why methane gas has been chosen by many researchers as a model compound for catalytic oxidation studies.

Complete oxidation or partial oxidation of methane can be performed over noble metals or transition metal oxides. Both catalysts have been extensively studied [2].

Noble metals have been extensively studied about their catalytic activity, mechanism of combustion and deactivation. The main advantage of noble metals is their superior catalytic activity in low temperature combustion. However, they are expensive and limited in source.

Among the noble metals, palladium (Pd) and platinum (Pt) are widely used and studied in catalytic methane oxidation. Oh et al have been studied the methane oxidation over alumina-supported noble metal catalysts with and without cerium additives. They found that, without cerium, Pd showed the highest activity among the Pt and Rh [3-4].

Metal oxides are also used in catalytic methane oxidation, even though they have lower activities than noble metals, but they are claimed to be more resistant to sulphur poisoning. Transition metal catalysts, such as copper oxide was found to be an efficient catalyst for total oxidation of methane with a selectivity of 100% to carbon dioxide and octahedrally coordinated Cu^{2+} ions are proved to be the active sites for methane combustion [5]. Pradier et al investigated four oxides for complete methane oxidation; they were MnO_2, Cr_2O_3, Co_3O_4, and CuO. They concluded that carbon dioxide productivity in complete oxidation is determined by metal oxide-support interaction [6].

As best of our reviews, there is no work on kinetics of binary platinum-chromium catalyst for methane oxidation, therefore we studied the methane oxidation over a platinum, chromium and binary platinum-chromium catalysts. The kinetic analyses of reaction rate were performed to study the oxidation mechanism of binary platinum-chromium catalyst and reaction orders with respect to methane and oxygen.

2. EXPERIMENTAL DETAILS

A. Catalysts Preparation

A platinum/alumina catalyst (2.0 wt% Pt/Al_2O_3) was prepared by an impregnation method. The required amount of aqueous H_2PtCl_6 solution as Pt source was impregnated into alumina powder. After evaporation, the dried sample was calcined in an air stream at 400 °C for 3 h. A chromium/alumina catalyst (3.0 wt% Cr/Al_2O_3) was prepared in the same way but using $Cr(NO_3)_2.9H_2O$ as metal source instead of H_2PtCl_6.

Binary Pt-Cr catalyst contain 2.0 wt% Pt and 3.0 wt.% Cr ($Cr/Pt/Al_2O_3$) was prepared by step-wise impregnation method. The Pt/Al_2O_3 catalyst was immersed in aqueous solution of $Cr(NO_3)_2.9H_2O$. After the drying and calcining process, $Cr/Pt/Al_2O_3$ catalyst was obtained.

B. Catalytic Test

The catalyst was pretreated by calcination in a stream of air at 500 °C for 1 h to remove impurities and then cooled to room temperature. A 0.25 g catalyst was placed into a fixed-bed reactor and was externally heated by a furnace connected to the temperature controller. The total flow rate was 26 ml/min and the feed gas consisting of methane (CH_4), oxygen (O_2), and argon (Ar) was introduced to the reactor. The reaction temperature was measured by a thermocouple inserted in the catalyst bed and ranged from 300-500 °C. The reactant and product composition were analyzed with an on-line gas chromatograph equipped with a thermal conductivity detector (TCD).

In the reaction rate measurements, the measurement was carried out at a constant temperature 435 °C under an atmospheric pressure. The feed gas consists of CH_4, O_2, and Ar. The ratio of CH_4-to-O_2 was varied within 0.1 - 0.25. In order to determine the reaction rates, the conversion of CH_4 was controlled below 11%.

3. RESULTS AND DISCUSSION

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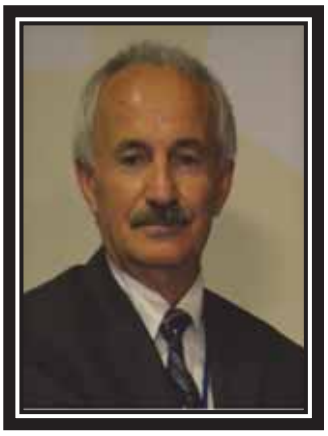

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Advanced Nanomaterials for Water and Wastewater Treatment: From Strategic Fundamental Research to Industry Adoption

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Water and wastewater treatment is known to be one of the most sustainable solutions to provide fresh and safe water for many water stressed communities and industrial sectors. Over the last decade, some concrete evidences indicate that the advances in advanced materials, particularly nanomaterials, have facilitated the next paradigm shift in the water and wastewater treatment processes. As the integration of nanotechnology with these processes is most likely to dominate the future research attention and the water treatment market, this presentation timely discusses the state-of-the-art overview on the enabling and cutting edge water and wastewater technology integrated with advanced nanomaterials in term of the technological needs and future perspective, which include the challenges and opportunities of nano-enabled water treatment processes. The key issues such as scale-up, economic competitiveness, potential environmental impacts and energy consumption are discussed. This presentation also aims to provide directions and guideline to the research community regarding the future outlook and roadmap of the application of nanotechnology to heighten the performance of the existing water and wastewater treatment processes in bench-scale and commercialization level. By taking all key aspects into account, the water community should reach a general consensus on a holistic technological strategy to make decision about the future direction of nano-enabled water and wastewater treatment scenario. It is crucial to identify the missing pieces and create effective linkages among important elements in order to embrace the revenue-based opportunities of this technology at its best time.

Keywords: advanced nanomaterials, water and wastewater treatment

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